Shoot and Cluster Correlation Among Pinot Noir Clones

By
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Abstract

There are 43 clones of Pinot Noir currently published by the National Technical Institution for Viticultural Improvement in France (ENTAV) and over 75 selections from Foundation Plant Services (FPS) at UC Davis. Viticulturists speculate that there are anywhere from 200 – 1,000 genetic variants that may exist for any given grape variety. An important part of vineyard management is crop estimation. The purpose of this project is to see if there is correlation in the number of shoots a vine produces and the number of clusters it produces and comparing that correlation with seven different Pinot Noir clones. The clones I sampled were PN 5, 2A, 23, 115, 667, 777 and 828, and the parameters I collected data on were number of shoots and clusters for all sample vines, and the ratio of clusters/vine to shoots/vine. Clones 5 and 115 had significantly higher numbers of shoots per vine than Clone 777; Clones 5, 23 and 828 had significantly higher numbers of clusters than Clone 777; and Clones 2A, 5, 23, and 828 had significantly higher cluster/shoot ratios than Clone 115. This information could ultimately help us understand which clones produce a greater or lesser amount of clusters, shoots and clusters/shoot, which will help growers decide which Pinot Noir clones to plant.

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Introduction

This project was being conducted in order to see if there was a correlation between the number of shoots a grape vine produces and how many clusters it produces. I also tried to determine if there was any difference in that correlation between clones of a variety. I used Pinot Noir grape vines in my experiment. The Pinot Noir clones that I compared were 5, 23, 2A, 115, 667, 777, and 828.

Crop estimation is an important part of vineyard management. Trying to estimate and having an educated idea of how much fruit a vineyard will produce is important. When selling fruit to wineries, the purchasing winery will want to have an idea of how much fruit it wants. This is based on winery size, sale expectations,. Therefore it's important for the grower to know how much fruit he expects to produce. Crop estimations are usually broken down into tons per acre and often how many tons each block will produce. Having a better understanding of how many clusters a vine will produce could help in determining crop estimates.

Literature Review

History of Pinot Noir and Crop Estimation

Pinot Noir is a red wine grape variety of the species *Vitis vinifera*. Its origin is unclear, but Pinot Noir grapes are grown around the world. It is primarily grown in cooler regions. France and the United states are two of the leading producers of Pinot Noir. It is also grown in Australia, Austria, Canada, the UK, Germany, Italy, Moldova, New Zealand, Spain and Switzerland (Barr 1993).http://enwikipedia.org/wiki/Pinot_Noir).

Pinot Noir clusters are typically some of the smallest compared to many other varieties. Moreover, its clusters can vary significantly depending on clone. Growing conditions also play a major role in determining crop estimates. Having an accurate cluster count and cluster weight are important parts of coming up with accurate crop estimates.

How to estimate grape yields in "tons per acre" is a simple formula (Dami 2011):

(CW*NC*ANV)/2000 = PY

PY = predicted yield (tons per acre)

ANV = actual number of vines / acre

NC = number of clusters per vine

CW = cluster weight (in pounds)

The vineyard in which I conducted the experiment has 3630 vines per acre, which is a very high density planting compared to other vineyards in California. In my experience, the majority of vineyards in California have less vines per acre than the Panorama vineyard. The vines were spaced 3 ft apart within the row and the row width was 4 ft. Clusters can be weighed at different times during the season, and the lag phase is one of those times. At lag phase one can assume that the cluster weighs a certain percentage of what the cluster will weigh at harvest. Many times, growers will weigh the clusters as they get closer to harvest to have a better idea of what kinds of yields they can expect. Using historical data for cluster weights is another way to select a number to use as an estimate of cluster weight. The other number needed in the formula is a cluster number. One can count clusters from the time they can be identified on the shoots. There are many variables that may change this number as the year progresses. Some of those variables are pests, viticultural practices, and environmental factors. If a pest damages a cluster, that cluster might not be harvested. The environment, such as wind, rain, sunburn and frost, can also damage clusters. A grower's cluster count may also change as viticultural practices are undertaken, such as shoot thinning, suckering and crop thinning.

An example of a crop estimate at the vineyard where I conducted the experiment could be similar to this: 3630(vines/acre)*11(clusters/vine)*0.18(cluster weight) / 2000 = 3.59 tons per acre.

In grape crop yield estimation there are often many other steps taken to help estimate crop level. Many growers take shoot counts and bud counts before they actually count clusters. If a grower has an idea, possibly from historical data, of how many clusters per shoot he may have, it can help to predict what the crop level will be earlier in the season. This is what makes this project relevant. It is already known that the clone of a variety has an influence on the size of the cluster. Some grape varieties and clones of varieties might produce more clusters than others.

Other reports have been done comparing yields to vegetative growth. (Naor et al. 2002) studiedeffects of two shoot densities (14 and 44 shoots/vine) and two crop levels (one and two fruit clusters per shoot) on yields, pruning weight, crop load and juice and wine quality of field-grown Sauvignon blanc over a course of three years. In this study they found that crop yield to pruning weight and crop yield to leaf area ratios were highly correlated. The yield per vine was linearly related to the number of clusters, up to 45 clusters per vine and leveled off at approximately 80 clusters per vine. Both shoot and cluster thinning reduced crop yield per vine. Yield per shoot increased gradually in the 14 shoot vines during the experimental years and exceeded that of the 44 shoot vines. Cluster weight was lower in the high shoot number vines and increased as the number of clusters per shoot decreased from two to one. Berry weight was not affected by the number of shoots per vine and increased slightly in 1992 only due to cluster thinning. There were no significant interactions between shoots per vine and cluster per shoot for berry weight. Crop load expressed as crop to pruning weight ratio was highly correlated with fruit weight to leaf area ratio, providing a biological rationale fro the relevance of crop load and wine quality relations.

Another study was done by Kurtural et al. (2006) In this study different pruning, cluster and shoot levels were compared and measured in two vineyards. In both years there was very little interaction of pruning and cluster thinning. The proportion of non-count shoots increased with the canopy in response to increased pruning severity. Pruning weights decreased with the increase in the number of clusters retained per vine. The results provided valuable information for growers of Chambourcin grapevines in the lower Midwestern US as well as in other climates with long growing seasons.

Materials and Methods

The name of the vineyard in which I conducted the experiment is the Panorama vineyard owned by Jackson Family wines. This vineyard is located in the Arroyo Seco appellation in Soledad, California. The vineyard is 405 acres and is primarily planted to Pinot Noir and approximately six acres is planted to Riesling.

I sampled a total of 420 vines. There were two sample blocks of 30 vines for each clone. The experiment included the following seven clones; Clone 5, Clone 2A, Clone 23, Clone 115, Clone 667, Clone 777 and Clone 828. Each of the sample blocks was at different locations throughout the vineyard to maximize sample variability and randomness.

The data I collected were taken during the 2009 growing season. After winter pruning in early 2009 I counted the number of buds for each sample vine. Then during March and April I counted the number of shoots per vine for each sample vine. Cluster counts were done after berry set in June. From these data I was able to get the mean number of shoots, the mean number of clusters and get a ratio of clusters/vine to shoots/vine, which could give an idea of which clones produce a greater amount of clusters per shoot, potentially giving a grower higher yields.

I analyzed average shoot and cluster counts, and average clusters per shoot by analysis of variance (ANOVA), using Fisher's LSD to separate means among clones. (SAS 2008).

Results

There was a statistically significant difference in the average number of shoots per vine among clones (F=13.6, df=6, 406, $p<0.0001$), Fig. 1. Clones 5 and 115 had the highest number of shoots at an average of 12.4 and 12.35, respectively, which was significantly different from Clone 777 at an average of 9.7 ($p<0.05$). Clones 23, 2A, 828 and 667 did not differ statistically from any other clone in average shoot number per vine.

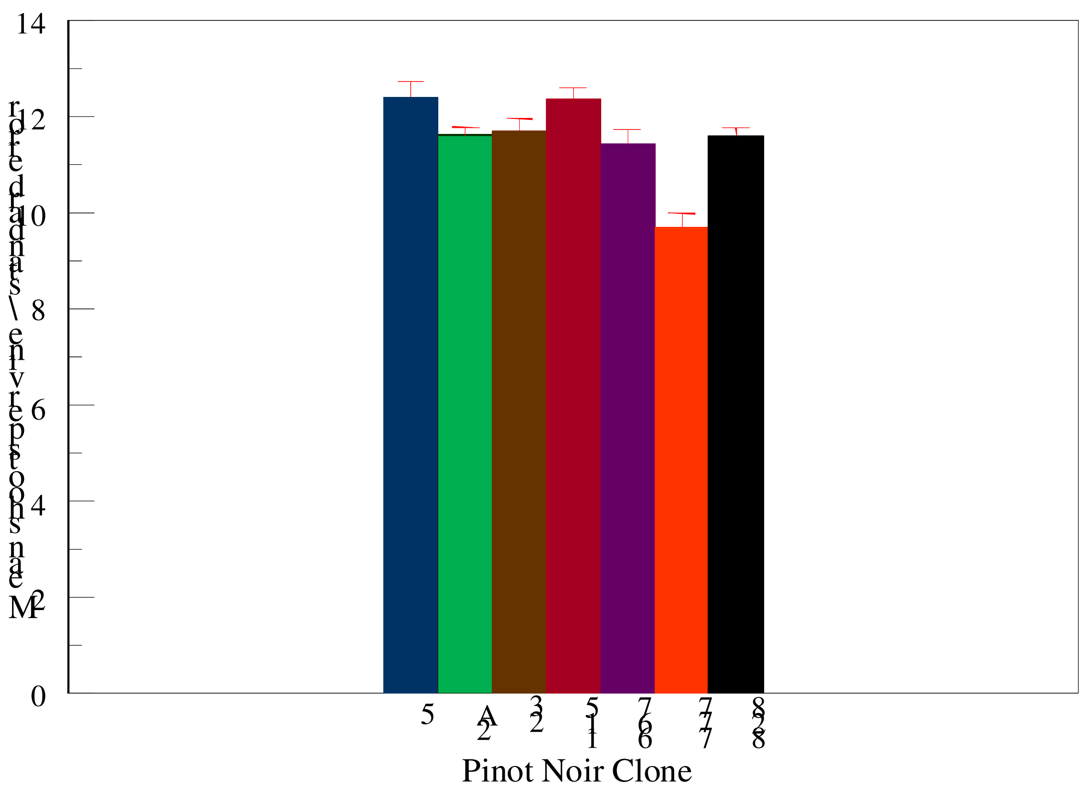

Figure 1. Mean number of shoots ± standard error for the seven Pinot Noir clones tested.

There was a statistically significant difference in the average number of clusters per vine among clones (F=17.5, df=6, 406, $p<0.0001$), Fig. 2. Clones 23, 5 and 828 had the highest number of clusters at an average of 20.0, 19.8 and 19.6, respectively, which was significantly different from Clone 777 at an average of 14.9 (p<0.05). Clones 2A, 667 and 115 did not differ statistically from any other clone in average cluster number per vine.

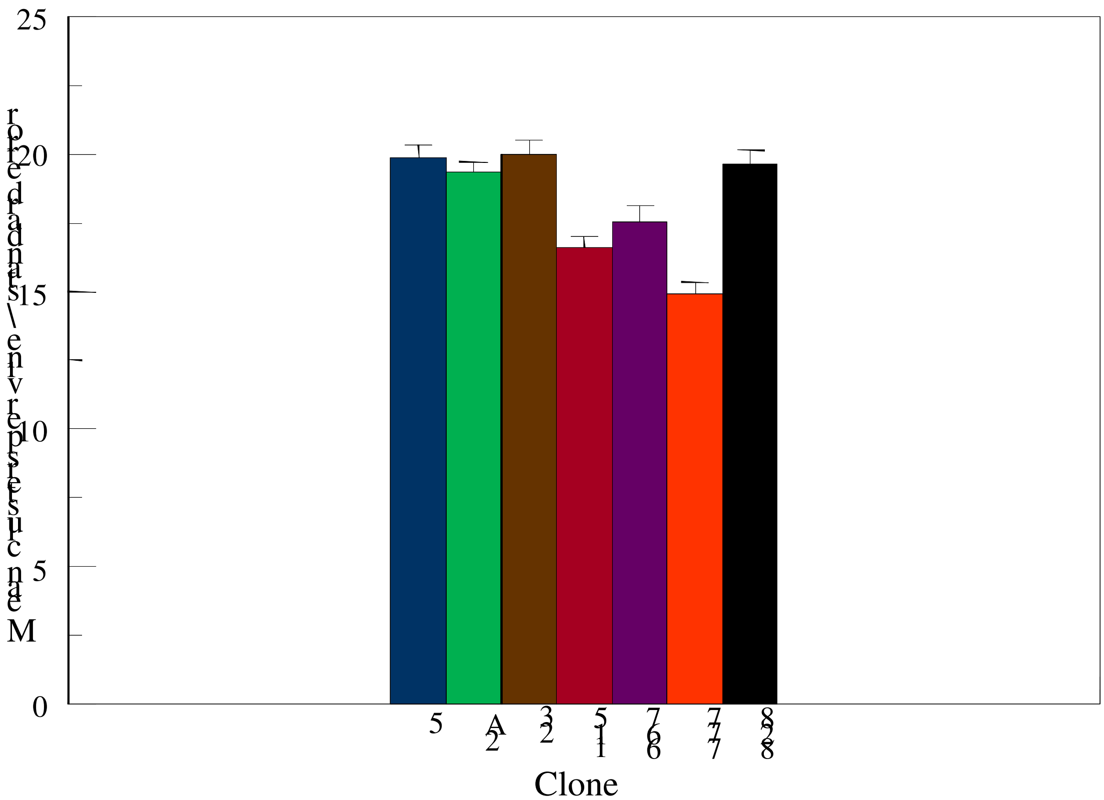

Figure 2. Mean number of clusters ± standard error for the seven Pinot Noir clones tested.

There was a statistically significant difference in average cluster per shoot ratio among clones (F=14.88, df=6, 404, p<0.0001), Fig. 3. Clones 23, 828, 2A and 5 had the highest cluster/shoot ratio, at an average of 1.71, 1.69, 1.67 and 1.62, respectively, which was significantly different from Clone 115 at an average of 1.34 (p<0.05). Clones 777 and 667 did not differ statistically from any other clone in average clusters per shoot per vine.

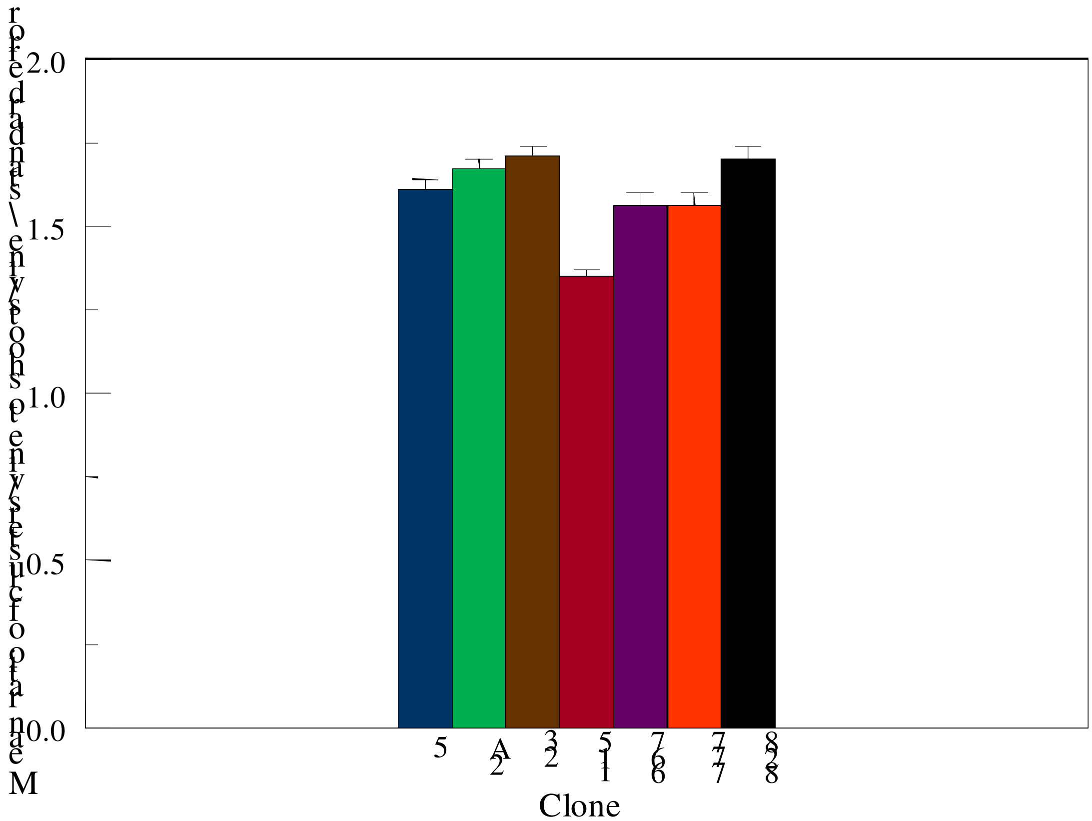

Figure 3. Ratio of clusters/vine to shoots/vine for the seven Pinot Noir clones tested.

Discussion

There are many Pinot Noir Clones and there are many factors that need to be considered when doing crop estimates. There are also many factors that go into deciding what types of varieties and/or clones to plant when developing a vineyard. Understanding what clones might give more or less yield potential can be helpful in many aspects of vineyard management and development. This study helps give us some information into the seven clones of Pinot Noir that were sampled and analyzed. Four clones-PN 23, PN 828, PN 2A and PN 5- produced a significantly greater cluster/shoot ratio than clone 4 (PN 115). This tells us that we can expect a greater number of clusters in these clones. The clones that had a higher ratio of shoots/vine to clusters/vine could potentially have higher yielding crops depending on the cluster weights of those clones.

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